

SOLID MECHANICS AND HYDRAULIC MACHINES**B Tech II Year II Sem**

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23ME401	Professional Core	L	T	P	4	CIE	SEE	TOTAL
		3	1	0		40	60	100
Contact Classes: 48	Tutorial Classes: 16	Practical Classes: Nil			Total Classes:64			

Course Objectives:

1. To identify an appropriate structural system and work comfortably with basic engineering mechanics and types of loading & support conditions that act on structural systems
2. To Understand the meaning of centers of gravity, centroids, moments of Inertia and rigid body dynamics
3. To Study the characteristics of hydroelectric power plant and Design of hydraulic machinery.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Solve problems dealing with forces, beam and cable problems and understand distributed force systems.
2. Solve friction problems and determine moments of Inertia and centroid of practical shapes.
3. Apply knowledge of mechanics in addressing problems in hydraulic machinery and its principles that will be utilized in Hydropower development and for other practical usages.

UNIT-I:

INTRODUCTION OF ENGINEERING MECHANICS: Basic concepts of System of Forces-Coplanar Forces-Components in Space-Resultant- Moment of Forces and its Application – Couples and Resultant of Force System-Equilibrium of System of Forces-Free body diagrams-Direction of Force Equations of Equilibrium of Coplanar Systems and Spatial Systems – Vector cross product- Support reactions different beams for different types of loading – concentrated, uniformly distributed and uniformly varying loading. Types of friction – Limiting friction – Laws of Friction – static and Dynamic Frictions – Angle of Friction –Cone of limiting friction

UNIT-II:

CENTROID AND CENTER OF GRAVITY: Centroids – Theorem of Pappus- Centroids of Composite figures – Centre of Gravity of Bodies – Area moment of Inertia:-polar Moment of Inertia-Transfer- Theorems - Moments of Inertia of Composite Figures.

SIMPLE STRESSES AND STRAINS ANALYSIS: Concept of stress and strain- St. Venant's Principle- Stress and Strain Diagram - Elasticity and plasticity – Types of stresses and strains- Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Pure shear and Complementary shear - Elastic modulii, Elastic constants and the relationship between them

UNIT-III:

KINEMATICS & KINETICS: Introduction – Rectilinear motion – Motion with uniform and variable acceleration–Curvilinear motion– Components of motion– Circular motion Kinetics of a particle – D'Alembert's principle – Motion in a curved path – work, energy and power. Principle of conservation of energy – Kinetics of a rigid body in translation, rotation – work done – Principle of work- energy – Impulse-momentum.

UNIT-IV:

BASICS OF HYDRAULIC MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency Elements of a typical Hydropower installation – Heads and efficiencies

UNIT-V:

TURBINES & PUMPS: Classification of turbines – Pelton wheel – Francis turbine – Kaplan turbine – working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency. Governing of turbines, Performance of turbines Pump installation details – Classification – work done – Manometric head – minimum starting speed – losses and efficiencies – specific speed. Multistage pumps – pumps in parallel

TEXT BOOKS:

1. M.V. Seshagiri Rao and Durgai, "Engineering Mechanics", University Press.
2. P.N Modi and Seth, "Fluid Mechanics and Hydraulic Machinery", standard Book House

REFERENCE BOOKS:

1. B. Bhattacharya, "Engineering Mechanics", Oxford University Publications.
2. Hibbeler, "Engineering Mechanics (Statics and Dynamics)", Pearson Education.
3. Ferdinand L. Singer, "Engineering Mechanics" Harper Collins Publishers.
4. A.K.Tayal, "Engineering Mechanics", Umesh Publication.
5. Domkundwar & Domkundwar, "Fluid mechanics & Hydraulic Machines", Dhanpat Rai & C
6. R.C.Hibbeler, "Fluid Mechanics", Pearson India Education Services Pvt. Ltd
7. D.S.Kumar, "Fluid Mechanics & Fluid Power Engineering", Kataria & Sons Publications Pvt. Ltd.
8. Banga & Sharma, "Hydraulic Machines" Khanna Publishers.